



# HIRI NEWS



## ***Recent LBNL Research, A Cool Savings Program Update, Gilbert, AZ's General Plan, Houston Cool Cities Effort, and more!***

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### **Pavement Reflectance Study**

Dr. Mel Pomerantz of the Lawrence Berkeley National Lab (LBNL) joined the call to discuss the new study, "Examples of Cooler Reflective Streets for Urban Heat Islands: Cement Concrete and Chip Seals."

The study considers two light colored, cool alternatives to traditional paving materials: portland cement concrete (PCC) and chip seals, both of which are used in the San Francisco Bay area. The study reports measurements of the albedos and temperatures of local PCC and chip sealed pavements. It also considers how the albedos of the concrete's constituent materials (aggregate, sand and cement)

contribute to the albedo of the finished concrete.

An important finding from the study is that the albedos of chip seals decrease with age (and use) but remain slightly higher than standard asphalt concrete over time. LBNL also found that a newly placed chip seal gets its albedo from the aggregate it contains. In San Jose, this was measured at 0.20. Over five years, it decreased to approximately 0.12. Because the City of San Jose has been using chip seals for more than twenty years for regular maintenance, LBNL was able to perform this analysis.

The Lab also noted that the rain in San Jose did not noticeably clean the chip seal pavements. Similarly, their attempts to manually scrub the material was ineffectual, but more powerful methods might succeed.

On the PCC side, Mel said that its albedo is maintained at a relatively high level for many years after the pavement sets. While the age of measured PCC streets in San Francisco could not be precisely determined, albedo measurements in most cases were in the range 0.35-0.18. Mel suggested that measurements on the high end of this range correspond to both streets with less traffic and newer streets.

These findings are important in light of the fact that paved surfaces cover a remarkably large fraction of urban areas. Detailed examination of Sacramento, for instance, showed that 39% of the area seen from above the tree canopy was paved (with roads, parking areas, and sidewalks).

## Fabric Analyses and Energy Savings Studies

Dr. Hashem Akbari, also from LBNL, discussed the Lab's Chicago urban fabric analysis and their energy savings study of Chicago and Houston.

Hashem began with the urban fabric analysis. He noted that the relevant land use/land classification data, in the context of heat island mitigation, are used to estimate the impact of light-colored surfaces and urban vegetation on the city's meteorology and air quality. As a result, fabric analyses are a necessary first step in designing effective heat mitigation programs.

Hashem also talked about LBNL's research approach, which uses a Monte-Carlo statistical technique. By doing so, the Lab can develop data on surface-type distribution and city-fabric makeup with aerial color orthophotography. The digital aerial photographs for Chicago covered a total of about 36 km<sup>2</sup>, or 14 mi<sup>2</sup>, resulting in approximately 3.9 x 10<sup>8</sup> pixels of data at 0.3-m resolution.

Hashem said that three major land-use types were examined in the fabric analysis: 1) commercial, 2) industrial, and 3) residential. For the areas analyzed, on average, vegetation covers 32% of the area, roofs cover 26%, and paved surfaces 26%. In commercial areas, paved surfaces cover 50-60% of the area, and in residential areas, they cover about 29% of the area.

To conduct their analysis, LBNL used Land-use/land-cover (LULC) data from the United States Geological Survey. This information allows the Lab to extrapolate results from neighborhood scales to metropolitan Chicago. Results at this level indicate that, in an area roughly 2500 km<sup>2</sup>, most of metropolitan Chicago (over 53%) is residential. The total roof area is about 680 km<sup>2</sup>, total paved surface area (roads, parking areas, sidewalks) is

approximately 880 km<sup>2</sup>, and total vegetated area is about 680 km<sup>2</sup>.

Moving on to discuss energy savings, Hashem summarized the results of LBNL's Chicago and Houston work. In the analysis, the Lab focused on the three building types offering the most savings potential: single-family residence, office and retail store.

Each building type was characterized in detail by old or new construction, and with a gas furnace or an electric heat pump. The study used the prototypical building characteristics developed in previous work for each building type, and simulated the impact of heat island reduction strategies on several endpoints: building cooling and heating-energy use, and peak power demand. LBNL used the DOE-2.1E model to conduct the analysis.

The simulations included the impact of (1) strategically-placed shade trees near buildings [*direct effect*], (2) use of high-albedo roofing material on the building [*direct effect*], (3) urban reforestation and high albedo pavements and surfaces [*indirect effect*] and (4) combined strategies 1, 2 and 3 [direct and indirect effects]. Next, the Lab estimated the total roof area of air-conditioned buildings in Chicago and Houston using available data to calculate the metropolitan-wide impact of the mitigation strategies.

The results show that in Chicago, potential annual energy savings of \$30M could be realized from the combined direct and indirect effects. Additionally, peak power avoidance is estimated at 400 MW with a reduction in annual carbon emissions at 58 kt. In Houston, the potential annual energy savings is estimated at \$82M, with a reduction of 730 MW in peak power and a reduction in annual carbon of 170 kt.

## Cool Savings Program Update

Kris Kiehne, of the Sacramento Cool Community Program, updated call participants on California's Cool Savings Program. She said that, to date, 27 M ft<sup>2</sup> of cool roof area has been approved statewide. Of this, 15 M ft<sup>2</sup> has been installed, resulting in 5 MW of energy savings. Kris said that schools have been an important participant in the Cool Savings Program, with 3 M ft<sup>2</sup> of installed roof space.

So far, many program customers have been referred by roof contractors. Education and outreach also play an important role in recruitment, and Kris is currently stepping efforts in this area, in preparation for the summer air conditioning season. The program will continue through December of this year.

Kris also noted that while energy savings at the building-level has been achieved, the dispersed nature of roof applications makes heat island mitigation, per se, a challenge. Still, when Kris is educating customers about cool roofs, she mentions that heat mitigation potential is an important public benefit of cool roofs.

## Gilbert, AZ's General Plan

Paul Hollar, a private citizen in Gilbert, AZ, has been active in promoting local heat island reduction measures. Recently he was successful in getting relevant language in Gilbert's General Plan. Paul joined the call to talk about his achievement.

For the last several years, Paul has written letters, made phone calls, and attended meetings to promote heat island mitigation. However, after receiving a promising letter from the mayor expressing interest in this subject, nothing happened. For a while his efforts seemed unproductive. But then heat island

reduction measures were finally included in the General Plan, which passed the Town Council.

Here is an example of the language in Section 10 of the Plan: "Policy 9.6. Extensively landscape parking areas to reduce heat gain, to visually relieve large parking lots, and to provide shade for vehicles and pedestrians.

And Policy 9.7. "Architecturally integrate the design of parking shade structures and garages with the design of the principal structures on the site."

Furthermore, the planning guidelines for roadway design also contain heat island mitigation language: "The design of roadways creates an initial impression of the community to businesses, visitors and residents. Wider right-of-way widths allow for medians and detached meandering sidewalks on major and minor arterials. Landscaped medians do more than control traffic they create a more natural environment, which provides relief from the summer sun and help reduce the "Urban Heat Island" effect that desert community's experience."

Paul also facilitated the inclusion of heat island language into the General Plan's Circulation Element, which provides a framework for developing a comprehensive transportation, transit, and land use system. One of the "implementation strategies" instructs the town to, "Develop guidelines for Urban Heat Island mitigation by developing criteria for the use of cool pavement and cool roof technology and engineered green spaces when developing new road and renovation existing roads."

The language also instructs Gilbert to, "Develop a Town

sponsored pilot project to explore the uses of "cool" technologies in new development/redevelopment."

In addition to policy language, Paul successfully convinced Halberstam's food chain to install cool roofs on their local facilities. His next goal is to work on cool paving for Gilbert's street infrastructure, referred to as "the mile arterial grid" system.

## Houston Cool Cities Effort

Dana Easley, of Houston Advanced Research Center (HARC), talked next about the city's progress on their heat island mitigation plan. She identified the formation of three workgroups as the Center's main achievement to date.

The workgroups correspond to the dominant mitigation options: trees and vegetation, cool paving, and cool roofs. Dana said HARC is acting of behalf on the city to facilitate their goal of improved ozone air quality through heat island mitigation. She noted that lowering the ambient concentration of ozone is the primary motivating factor for Houston, and is why the workgroups had been formed.

Of the three workgroups, the tree committee has been the most active so far. The urban forest advocacy organization, Houston Green, has been taking the lead by compiling a city-wide reforestation plan. The organization is also putting together a list of recommendations to the city for enhancing Houston's urban forest. The US Forest Service is active, too, conducting an in-depth analysis of how trees affect air quality in the city.

The newsletter of Alliance for Community Trees (ACT) addresses planting trees in Houston for State Implementation Plan (SIP) credit in more detail: "The two year project [to investigate the potential for

stationary source SIP credit from trees is a partnership between the Texas Forest Service, community greening groups like Trees for Houston, HARC, and others. Researcher Dave Nowak of the US Forest Service will collect the detailed air quality data on the trees needed to meet EPA's confidence level. The \$500,000 project is supported in part through the federal Title VIII initiative passed by Congress for FY 2001."

Dana said the workgroups on cool paving and cool roofs have just been launched. The paving group, in particular, is hoping to have an LBNL staff person come to Houston to give a presentation on their work. The first cool roofs meeting is coming up soon.

## ACPA Cool Community Outreach & Education

Jim Scapaletto, Southeast Regional Consultant at the American Concrete Pavement Association (ACPA), discussed the cool community outreach his organization is engaged in. (ACPA is a national association representing concrete pavement contractors, cement companies, equipment and material manufacturers and suppliers.)

Jim's strategy involved training more than 50 promoters (most of whom are ACPA members or employees) on heat island science and mitigation options, especially how light-colored paving materials can improve local air quality. He then identified four audiences for the promoters to target with this information: state and local planners and staff, architects and engineers, business and industry, and public organizations like the Kiwanas and Lions clubs.

So far the promoters have made over one hundred presentations in Southern cities concerned about ozone air quality. Despite this progress, Jim says ACPA's outreach would benefit from accurate data on how heat island mitigation would

affect air quality in specific target cities. He notes that much cool community research thus far has focused on Atlanta, but Southern cities need tailored information.

As a result, ACPA is interested in an action "template" that could be applied in places like Charlotte and Birmingham to inform local officials about the level of effort required to improve air quality.

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**The next conference call is TBD. Stay tuned for the date, call-in number, and access code.**

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